

What is claimed is:

1. A substrate processing apparatus that removes an unwanted material on a surface of a peripheral portion of a substrate through etching by supplying etching liquid to the
5 surface of the peripheral portion, the apparatus comprising:

an etching liquid supplying mechanism that supplies the etching liquid to the peripheral portion of the substrate; and

an annular member that has an inner periphery on or inside an outer periphery of the substrate and thereby defines a
10 processing width to be processed by the etching liquid on the surface of the peripheral portion of the substrate.

2. The substrate processing apparatus according to Claim 1, wherein:

15 the annular member is placed in close proximity to the surface of the peripheral portion of the substrate while securing a certain gap such that allows the annular member to come in contact with a liquid film of the etching liquid formed on the surface of the peripheral portion.

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3. The substrate processing apparatus according to Claim 1, further comprising:

a substrate holding mechanism that holds the substrate from one surface side thereof,

25 wherein the annular member is placed on the other surface

side of the substrate.

4. The substrate processing apparatus according to Claim 1, wherein:

5 the etching liquid is supplied to the peripheral portion of the substrate from the etching liquid supplying mechanism while the substrate is held at rest.

5. The substrate processing apparatus according to Claim 10 1, wherein:

the substrate is a substrate of a nearly circular shape;

the apparatus further comprises a substrate rotating mechanism that rotates the substrate; and

15 the inner periphery of the annular member is of a circular shape having an inside diameter equal to or smaller than a diameter of the substrate.

6. The substrate processing apparatus according to Claim 5, wherein:

20 the etching liquid is supplied to the peripheral portion of the substrate from the etching liquid supplying mechanism while the substrate is rotated by the substrate rotating mechanism.

25 7. The substrate processing apparatus according to Claim

1, wherein:

the annular member includes a substrate-opposing surface that extends outwards from the inner periphery and opposes the surface of the peripheral portion of the substrate.

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8. The substrate processing apparatus according to Claim 7, wherein:

the substrate-opposing surface is a plane nearly parallel to the surface of the peripheral portion of the
10 substrate.

9. The substrate processing apparatus according to Claim 7, wherein:

the substrate-opposing surface is an inclined plane
15 inclined to reduce an interval between the substrate-opposing surface and the substrate as heading toward the inner periphery.

10. The substrate processing apparatus according to
20 Claim 7, wherein:

an outer periphery of the substrate-opposing surface is located outside the outer periphery of the substrate.

11. The substrate processing apparatus according to
25 Claim 7, wherein:

the annular member includes a projection that protrudes from the substrate-opposing surface toward the substrate and thereby limits the etching liquid heading toward an inside of the substrate.

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12. The substrate processing apparatus according to Claim 11, wherein:

the projection includes, on an outer side of the annular member, an etching liquid limiting surface having an inclined
10 plane that heads toward an outside of the substrate as going away from a surface of the substrate.

13. The substrate processing apparatus according to Claim 7, wherein:

15 the annular member includes a liquid discharge path that opens in the substrate-opposing surface and communicates with an external space of the annular member.

14. The substrate processing apparatus according to
20 Claim 7, wherein:

the etching liquid supplying mechanism includes a liquid dispense path made in the annular member and including a dispense port that opens in the substrate-opposing surface.

25 15. The substrate processing apparatus according to

Claim 7, wherein:

the etching liquid supplying mechanism includes a
dispense port that opens in the substrate-opposing surface,
a liquid-receiving portion that communicates with the dispense
5 port, and a nozzle that supplies the liquid-receiving portion
with the etching liquid.

16. The substrate processing apparatus according to
Claim 15, wherein:

10 the annular member is placed so that the
substrate-opposing surface opposes the substrate from above;
and

the liquid-receiving portion is formed in an upper
surface of the annular member.

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17. The substrate processing apparatus according to
Claim 1, wherein:

the etching liquid supplying mechanism includes a nozzle
that supplies the etching liquid toward a surface of the
20 substrate on an opposite side to a surface containing the
surface of the peripheral portion.

18. The substrate processing apparatus according to
Claim 17, wherein:

25 the nozzle supplies the etching liquid toward a central

portion of the surface on the opposite side.

19. The substrate processing apparatus according to claim 1, wherein:

5 the annular member has an outer wall surface positioned inside the outer periphery of the substrate.

20. The substrate processing apparatus according to claim 19, wherein;

10 the etching liquid supply mechanism includes a nozzle provided outside the annular member.

21. The substrate processing apparatus according to Claim 1, wherein:

15 the etching liquid supplying mechanism includes a nozzle that supplies the etching liquid toward an outer wall surface of the annular member.

22. The substrate processing apparatus according to
20 Claim 1, wherein:

the etching liquid supplying mechanism includes a dispense port through which the etching liquid is dispensed in a direction perpendicular to a surface of the substrate or a direction inclined toward an outside of the substrate.

23. The substrate processing apparatus according to Claim 1, wherein:

the annular member includes an inner wall surface that rises from the inner periphery in a direction to go away from
5 a surface of the substrate.

24. The substrate processing apparatus according to Claim 23, wherein:

the inner wall surface is an inclined plane that heads
10 toward a center of the substrate as going away from the surface of the substrate.

25. The substrate processing apparatus according to Claim 1, further comprising:

15 a lid member that substantially clogs an internal space of the annular member.

26. The substrate processing apparatus according to Claim 25, wherein:

20 the annular member includes an annular groove formed adjacently inside the inner periphery.

27. The substrate processing apparatus according to Claim 1, further comprising:

25 a gas supplying mechanism that supplies an internal space

of the annular member with a gas.

28. The substrate processing apparatus according to Claim 27, wherein:

5 the annular member includes an inner wall surface that rises from the inner periphery in a direction to go away from a surface of the substrate, and the gas supplied from the gas supplying mechanism is supplied toward the inner wall surface.

10 29. The substrate processing apparatus according to Claim 23, wherein:

 the annular member includes a gas flowing path that allows a communication between an internal space and an external space of the annular member.

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30. The substrate processing apparatus according to Claim 1, further comprising:

 a protection liquid supplying mechanism that supplies etching protection liquid toward a center of the substrate at
20 an inner side of the annular member.

31. A substrate processing method of removing an unwanted material on a surface of a peripheral portion of a substrate through etching by supplying etching liquid to the surface of
25 the peripheral portion, the method comprising:

a step of placing a mound of the etching liquid on the surface of the peripheral portion of the substrate while the substrate is held at rest; and

a step of placing an annular member, having an inner
5 periphery on or inside an outer periphery of the substrate, in close proximity to the surface of the peripheral portion of the substrate and thereby defining a processing width to be processed by the etching liquid on the surface of the peripheral portion of the substrate.

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32. The method according to Claim 31, wherein:

the annular member placing step includes a step of placing the annular member while securing a certain gap such that allows the annular member to come in contact with a liquid
15 film of the etching liquid formed on the surface of the peripheral portion of the substrate.

33. The method according to Claim 32, further comprising:

a gas supplying step of supplying an internal space of
20 the annular member with a gas.

34. The method according to Claim 32, further comprising:

a protection liquid supplying step of supplying etching protection liquid to a central region of the substrate at an
25 inner side of the annular member.

35. A substrate processing method of removing an unwanted material on a surface of a peripheral portion of a substrate through etching by supplying etching liquid to the surface of
5 the peripheral portion, the method comprising:

a step of performing, in parallel,

(a) a substrate rotating step of rotating the substrate,
and

(b) an etching liquid supplying step of supplying the
10 etching liquid to the surface of the peripheral portion of the substrate being rotated; and

a step of placing an annular member, having an inner periphery on or inside an outer periphery of the substrate, in close proximity to the surface of the peripheral portion
15 of the substrate and thereby defining a processing width to be processed by the etching liquid on the surface of the peripheral portion of the substrate.

36. The method according to Claim 35, wherein:

20 the annular member placing step includes a step of placing the annular member while securing a certain gap such that allows the annular member to come in contact with a liquid film of the etching liquid formed on the surface of the peripheral portion of the substrate.

37. The method according to Claim 35, wherein:

the etching liquid supplying step includes a step of supplying the etching liquid toward a surface of the substrate on an opposite side to a surface containing the surface of the peripheral portion.

38. The method according to Claim 35, further comprising:

a gas supplying step of supplying an internal space of the annular member with a gas.

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39. The method according to Claim 35, further comprising:

a protection liquid supplying step of supplying etching protection liquid to a central region of the substrate at an inner side of the annular member.

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40. A substrate processing apparatus that applies processing to a peripheral portion of a substrate with the use of processing liquid, the apparatus comprising:

a substrate holding mechanism that holds the substrate almost horizontally and rotates the substrate about a nearly vertical rotational axis line;

an opposing member that includes a substrate-opposing surface opposing an upper surface of the substrate held by the substrate holding mechanism and having a hydrophobic property at least in a peripheral portion region, and a hydrophilic upper

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surface inclined to near an end edge of the substrate-opposing surface as heading downward, the opposing member protecting a central portion of the upper surface of the substrate by bringing the substrate-opposing surface in close proximity to
5 the upper surface of the substrate; and

a processing liquid supplying mechanism that supplies the processing liquid to the upper surface of the opposing member.

10 41. The substrate processing apparatus according to Claim 40, wherein:

the opposing member is formed in a shape of a rotational body having an axis line nearly along the rotational axis line as a central axis line.

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42. The substrate processing apparatus according to Claim 40, wherein:

the opposing member further includes a hydrophilic side surface that connects the end edge of the substrate-opposing
20 surface and an end edge of the upper surface of the opposing member.

43. The substrate processing apparatus according to Claim 40, further comprising:

25 an inert gas supplying mechanism that supplies an inert

gas to a space between the upper surface of the substrate held by the substrate holding mechanism and the substrate-opposing surface.

5 44. A substrate processing apparatus that applies processing, with the use of processing liquid, to a region to be processed including at least part of a peripheral portion of a substrate, the apparatus comprising:

 a substrate holding mechanism that holds the substrate;
10 an opposing member that includes a substrate-opposing surface opposing an upper surface of the substrate held by the substrate holding mechanism and having an end edge corresponding to a boundary set on the upper surface of the substrate to divide the region to be processed and a region
15 not to be processed as well as having a hydrophobic property at least in a peripheral portion region, and an hydrophilic upper surface inclined to near the end edge of the substrate-opposing surface as heading downward, the opposing member protecting the region not to be processed on the upper
20 surface of the substrate by brining the substrate-opposing surface in close proximity to the upper surface of the substrate; and

 a processing liquid supplying mechanism that supplies the processing liquid to the upper surface of the opposing
25 member.

45. The substrate processing apparatus according to
Claim 44, wherein:

the opposing member further includes a hydrophilic side
5 surface that connects the end edge of the substrate-opposing
surface and an end edge of the upper surface of the opposing
member.

46. The substrate processing apparatus according to
10 Claim 44, further comprising:

an inert gas supplying mechanism that supplies an inert
gas to a space between the upper surface of the substrate held
by the substrate holding mechanism and the substrate-opposing
surface.

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47. A method of applying processing to a peripheral
portion of a substrate with the use of processing liquid, the
method comprising:

a substrate rotating and holding step of rotating the
20 substrate about a nearly vertical rotational axis line in an
almost horizontal posture by a substrate holding mechanism;

an opposing member approximating step of bringing an
opposing member, in close proximity to the upper surface of
the substrate held by the substrate holding mechanism, the
25 opposing member being provided with a substrate-opposing

surface opposing an upper surface of the substrate held by the substrate holding mechanism and having a hydrophobic property at least in a peripheral portion region and a hydrophilic upper surface inclined to near an end edge of the substrate-opposing surface as heading downward; and

a processing liquid supplying step of supplying the processing liquid to the upper surface of the opposing member in allowing the processing liquid to flow down to the peripheral portion of the substrate held by the substrate holding mechanism from the end edge of the substrate-opposing surface.

48. A method of applying processing to a region to be processed of a substrate with the use of processing liquid, the method comprising:

a substrate holding step of having a substrate holding mechanism hold the substrate almost horizontally;

an opposing member approximating step of bringing an opposing member, in close proximity to the upper surface of the substrate held by the substrate holding mechanism, the opposing member being provided with a substrate-opposing surface opposing an upper surface of the substrate held by the substrate holding mechanism and having an end edge corresponding to a boundary set on the upper surface of the substrate to divide the region to be processed and a region not to be processed as well as having a hydrophobic property

at least in a peripheral portion region and a hydrophilic upper surface inclined to near the end edge of the substrate-opposing surface as heading downward; and

a processing liquid supplying step of supplying the
5 processing liquid to the upper surface of the opposing member in allowing the processing liquid to flow down to the region to be processed of the substrate held by the substrate holding mechanism from the end edge of the substrate-opposing surface.

10 49. A substrate processing apparatus that applies processing to a peripheral portion of a substrate with the use of processing liquid, the apparatus comprising:

a substrate holding mechanism that holds the substrate almost horizontally and rotates the substrate about a nearly
15 vertical rotational axis line;

an opposing member placed oppositely to an upper surface of the substrate held by the substrate holding mechanism and including a projection strip protruding toward the substrate at an edge portion; and

20 a processing liquid supplying mechanism that supplies the opposing member with the processing liquid.

50. The substrate processing apparatus according to Claim 49, wherein:

25 the opposing member includes a substrate-opposing

surface having the projection strip protruding toward the substrate at an edge portion, and an upper surface connected to the projection strip; and

the processing liquid supplying mechanism supplies the
5 processing liquid to the upper surface of the opposing member.

51. The substrate processing apparatus according to Claim 50, wherein:

the upper surface of the opposing member is inclined to
10 near a periphery of the substrate held by the substrate holding mechanism as heading downward.

52. The substrate processing apparatus according to Claim 50, wherein:

15 the upper surface of the opposing member has a hydrophilic property.

53. The substrate processing apparatus according to Claim 49, wherein:

20 the projection strip of the opposing member has a lower end edge located above the peripheral portion of the substrate held by the substrate holding mechanism.

54. The substrate processing apparatus according to
25 Claim 49, wherein:

the projection strip of the opposing member includes, in a lower surface, a plane nearly parallel to the upper surface of the substrate held by the substrate holding mechanism.

5 55. The substrate processing apparatus according to Claim 49, wherein:

the projection strip of the opposing member includes, in a lower surface, an inclined plane that nears the upper surface of the substrate held by the substrate holding
10 mechanism as approaching the rotational axis line.

56. The substrate processing apparatus according to Claim 49, wherein:

the projection strip of the opposing member includes,
15 in a lower surface, a hydrophilic surface opposing the upper surface of the substrate held by the substrate holding mechanism.

57. The substrate processing apparatus according to
20 Claim 49, further comprising:

an opposing member rotating mechanism that rotates the opposing member about the rotational axis line.

58. The substrate processing apparatus according to
25 Claim 57, wherein:

the opposing member rotating mechanism rotates the opposing member at a rotational speed lower than a rotational speed at which the substrate is rotated by the substrate holding mechanism.

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59. A method of applying processing to a peripheral portion of a substrate with the use of processing liquid, the method comprising:

a substrate rotating step of having a substrate holding
10 mechanism hold the substrate almost horizontally and rotating the substrate about a nearly vertical rotational axis line;

an opposing member approximating step of bringing an opposing member, in close proximity to the substrate held by the substrate holding mechanism, the opposing member being
15 placed oppositely to an upper surface of the substrate held by the substrate holding mechanism and including a projection strip protruding toward the substrate at an edge portion; and

a processing liquid supplying step of supplying the processing liquid to the opposing member in allowing the
20 processing liquid to flow down to the peripheral portion of the substrate held by the substrate holding mechanism from the projection strip.

60. The method according to Claim 59, wherein:

25 the opposing member includes a substrate-opposing

surface having the projection strip protruding toward the substrate at an edge portion and an upper surface connected to the projection strip; and

the processing liquid supplying step includes a step of
5 supplying the processing liquid to the upper surface of the opposing member.